RECENT CONTRIBUTIONS OF CHEMISTS TO MAINTAINING SOIL FERTILITY

A radio talk by Henry G. Knight, chief, Bureau of Chemistry and Soils, delivered in the Department of Agriculture period, National Farm and Home Hour, Wednesday, August 29, 1934, broadcast by a network of NBC and 50 associate radio stations.

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I suppose the members of this Farm and Home Hour audience are more wide awake than most people to the importance of maintaining the fertility of the nation's soil.

I happened to hear the very fine talk that one of the Department economists gave you people some months ago in the conservation programs. He pictured the variety and the richness of our land resources. He pointed out how we have carelessly let some of our land be wasted by erosion though we could control erosion if we set our minds and our energies to the job. He also called attention to the fact that taking off the crops each year and sending them away from the fields where they are grown removes from these fields some elements of soil fertility that ought to be replaced in order to keep up productive power.

Now, 25 years ago, scientists in this country were really somewhat worried about how to replace the nitrogen and the potassium and the phosphorus removed from the fields each year by harvesting and selling the crops. There was a real question as to whether the supply of soil nitrogen, especially, could be indefinitely replenished at a reasonable cost.

Chemists have dispelled those fears of a quarter of a century ago. They have developed methods of taking nitrogen out of the atmosphere that give us complete insurance against exhausting the supply of nitrogen for plant growth.

But the story of development of the nitrogen fixation industry has been told to you a good many times. I want to bring to your attention today some of the recent results of work on other phases of the problem of maintaining soil fertility by the use of chemicals. I shall mention the results of four research projects recently completed or partly completed by the scientists of the Bureau of Chemistry and Soils. The first one is their research on methods of treating the phosphate rock that occurs in many parts of this country so that it will be a better source of phosphorus for use in fertilizers. The second thing I want to call to your attention is recent results of work on methods of increasing the efficiency of high analysis fertilizers and thus reducing fertilizer costs to farmers. The third thing is our development of new methods for preparing fertilizers that will not have an acid effect on the soil. And the fourth thing is the discovery of the cause of some serious losses in potato yields along the Atlantic Seaboard, and methods of counteracting these causes.

Returning now to the first research result I wish to make a report on--I should explain that the element fluorine is present in all types of phosphate rock occurring in this country and in most other countries. Often the fluorine is tied up with the other chemical elements in the phosphate rock in such a way as to cut down their value for fertilizing. Fluorine lowers the fertilizing value of the raw rock by making the phosphorus content less soluble and thus

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keeping it from being available to the roots of the plants.

Obviously, then, our native phosphate rocks would be improved for use in fertilizers if there were a cheap method of getting the fluorine out of them. Our chemists believe that they have found such a method. It consists of heating the rock for a short time in the presence of water vapor and silica-that's just the chemist's name for sand. This process has worked well in the laboratory. Practical operating chemists believe it would work at a moderate cost in plants such as the ones now used in making Portland cement.

The product that we've turned out in our laboratory furnaces is just as good a fertilizer as superphosphate and the other well-known phosphate fertilizers. It is in a form that handles very easily and also makes easier to handle the other materials that it might be mixed with in making a complete fertilizer. Furthermore, it can be used as a substitute for bonemeal and mineral supplements in livestock feeding.

So much for that. Now I'll say a word or two about our research which aims to cut the cost of commercial fertilizers to farmers by increasing the efficiency of high analysis goods. I don't have time to tell you about all the different ways we have discovered of improving the chemical, physical and other properties of high analysis goods. When fertilizers of this kind were first placed on the market, they were unsatisfactory to handle in a good many ways. But recently we have found methods of preparing high analysis mixtures that will be just as easy to handle as the best grades of the old time mixes. You can easily realize what a saving this represents by comparing retail prices for the fertilizers of the old time formulas and of the new high analysis formulas.

For instance, compare the present selling prices of a 2-8-2 and a 4-16-4 fertilizer. You get twice as many units of plant food in the concentrated mix, but the cost of the extra 12 units is less than half as much as the cost of the 12 units in the 2-8-2 mixture. I think it is evident from this example that the improvements in high analysis fertilizers offer a possibility of reducing fertilizer bills of farmers by many millions of dollars.

Just a word on the methods we've tried out for preparing fertilizers that are non-acid forming. I'm going to have a little bit more to say in a moment about the effects of fertilizers that are acid-forming. It will be sufficient to say right now that we have found that the acidifying action of fertilizers may be corrected by including in the mixture a sufficient quantity of liming material, such as limestone or dolomite. Of course, most farmers who use fertilizers know that it is not safe to use very much straight limestone in a fertilizer mixture, because it interacts with the other fertilizer elements and causes the mix to lose a part of its value as plant food. However, we've recently made an important discovery, namely, that dolomite -- a kind of limestone that contains magnesium -- can be used with safety in any proportion in all fertilizer mixtures.

The mention of this magnesium-containing dolomite brings me to the fourth report I want to make to you today -- the report on the results of cooperative investigations with state experiment stations carried on over the past 5 years to determine the causes of some serious drops in potato yields on different important soil types along the Atlantic Seaboard from Maine clear down to Virginia.

Again, I would like to give you the story in detail, but it's a little bit too long. Briefly, we think this trouble -- this chlorotic condition, or loss of green color, of potatoes grown in several different soils -- started to develop some years back, when farmers in the East had to greatly curtail the use of manure because it was so hard to get and so expensive. About the same time fertilizer manufacturers turned from the organic nitrogen materials, such as tankage, fish scrap, and cottonseed meal.

For these expensive old-time organic nitrogenous fertilizers, they substituted cheaper inorganic sources of nitrogen, especially ammonium sulphate. This naturally cut down the amount of organic matter -- of humus -- supplied to the soils. And at the same time it cut down the amount of some of the less common elements of soil fertility -- such as magnesium -- that went back on the land each year. Furthermore, the newer commercial fertilizers of the ammonium sulphate types tend to make the soil have a more acid reaction. When the soil goes below a certain point in acidity, the magnesium is more readily dissolved and leached out. If the soil continues acid, the magnesium available to the plants becomes so scarce that the plants are not correctly nourished.

To make a long story short, it has been found in Maine and Virginia, very definitely, and a little less definitely in New Jersey and on Long Island, that the chlorotic disturbances that were cutting down potato yields were due to lack of magnesium content in the soils. Some phenomenal increases in potato yields were obtained from applying small amounts -- something like 150 pounds to the acre -- of common everyday epsom salts and other salts which contain magnesium.

And lately it has been determined that the best permanent treatment for these soils is to build up their magnesium content and reduce their acidity so that the magnesium already there will be unlocked. We can do this by applying dolomitic limestone -- the same limestone I was talking about awhile ago. That's the recommendation that extension workers are giving potato growers in Maine and Virginia now, wherever they're having this trouble caused by lack of magnesium in the soil.

This instance along with the results of our investigations showing that lack of manganese caused great cuts in crop yields on some Florida soils, demonstrates the importance of having our chemists keep on with their studies of the role that such chemical elements as iron, boron, selenium, aluminum, silicon, arsenic, the halogens, and colbalt, nickel and perhaps others play in the nutrition of our plants, and how their deficiency or over-abundance in some soils may be remedied.

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